

What did Mendel find?

Mendel crossed plants and counted the numbers of plants that resulted.

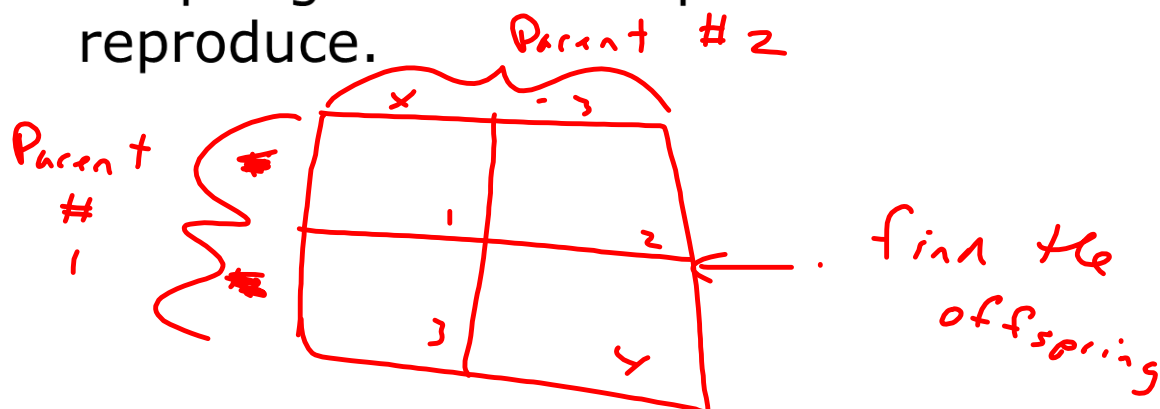
From the numbers he could predict 3 things:

1. the genotypes of the parents
2. the probable genotypes of the offspring
3. the predicted phenotypes of the offspring

Punnett Squares

Mendel used Punnett Squares to predict results.

A Punnett Square is a box that shows the gene combinations of parents and offspring were those parents to reproduce.



1. A tall pea plant (TT) is crossed with a short pea plant. What are the genotypes and phenotypes of the F_1 generation if tall is the dominant trait?

~~TT~~ $TT \times tt$ Genotypes

| | | |
|-----|------|------|
| | t | t |
| T | Tt | Tt |
| T | Tt | Tt |

$Tt = 100\%$
or $4/4$

Phenotype
Tall - 100% or $4/4$

2. A homozygous tall plant is crossed with a heterozygous plant. What are the genotypes and phenotypes of the offspring?

$TT \times Tt$ Genotype

| | | |
|-----|------|------|
| | T | t |
| T | TT | Tt |
| T | TT | Tt |

50% TT $\frac{2}{4}$
50% Tt $\frac{2}{4}$

100% tall Phenotype

We have been looking at what is known as a monohybrid cross - involves one gene pair of contrasting traits

In humans, smooth nails are dominant over bumpy nails. (Use B's)

1. What are the possible genotypes of humans?

BB, Bb, bb

2. What are the possible phenotypes of humans?

bumpy nails or smooth nails

3. What are the phenotypes of the offspring if a homozygous smooth-nailed ~~female~~ mates with a bumpy-nailed ~~male~~?

$BB \times bb$

| | | |
|-----|------|------|
| | b | b |
| B | Bb | Bb |
| B | Bb | Bb |

genotype
100% Bb
Phenotype 100%
Smooth

4. Two heterozygous green pea plants are crossed. What are the genotypes and phenotypes of the F₂ generation if green is dominant to yellow?

(use G's) $Gg \times Gg$

| | | |
|-----|------|------|
| | G | g |
| G | GG | Gg |
| g | Gg | gg |

Phenotype
75% green $\frac{3}{4}$
25% yellow $\frac{1}{4}$
genotype
25% GG
50% Gg
25% gg

Try This One

*Sometimes genetics work backwards to find out the genotypes of the parents.

5. In dogs, the gene for short hair is dominant to long hair. Two short haired dogs have a litter with 8 pups. Six puppies have short hair and two have long hair. What are the genotypes of the parents? (Use H's)

$$\frac{2}{8} = \frac{1}{4} = 25\%$$

$$\frac{6}{8} = \frac{3}{4} = 75\%$$

| | | |
|---|----|----|
| | H | h |
| H | HH | Hh |
| h | Hh | hh |

← fill in first

2. Grackles are small black birds seen commonly in NB. Suppose long tails (L) are dominant to short tails. A female short-tailed grackle mates with a long-tailed male grackle that had one parent short-tailed and one parent long-tailed. What is the genotype of the male?

3. Prove that every time humans mate there is a 50:50 chance of having a boy. XX is the genotype for a female and XY for a male.

4. In guinea pigs, a black coat is dominant over a white coat. (use B's)

A. What are the possible genotypes of guinea pigs?

B. What are the possible phenotypes of guinea pigs?

C. Can two white-coated guinea pigs produce a guinea pig with a black coat? Prove it.

5. In certain cattle the polled (hornless) trait is dominant over horns. A polled bull is mated to a cow with horns. Their calf is born and develops horns. The bull is then mated to another cow which is polled. Their calf also develops horns. Identify the genotypes of all the individuals. (use H's)

6. In horses the trotter characteristic is dominant to the pacer characteristic. A male trotter mates with 3 females. Each female produces a foal. The first female, a pacer, calves a pacer. The second female, also a pacer, calves a trotter. The third female, a trotter, calves a pacer. Determine the genotypes of all of the individuals. (use T's)